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INTERSTATE TRANSFER OF ELECTRIC POWER IN 1928

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Interstate Transfer of Power
By Electric Light and Power Companies in the United States

THE statistics herein contained were determined from reports received by the Statistical Research Department of the National Electric Light Association from its 143 reporting member companies that were engaged in the interstate transfer of electric power during 1928. These reported transactions embraced 93-1/3 per cent of the total power transferred across State lines. The balance, representing approximately fifty transactions comprising the remaining 6⅔ per cent, were estimated from the best available data to indicate the magnitude of each transaction.

The figures embrace the operations of enterprises primarily devoted to the generation and distribution of electricity. They do not include electric power entering into interstate transmission as generated by railroads, street railway systems, industrial enterprises not public utilities, and the United States Reclamation Service.

There are a few cases where the power generated in one State moved across part of a second State to reach its market in a third. In these instances such power was reckoned only once as "interstate power"—between the State where it was generated and the State where it was finally used.

Although power crossing Canadian or Mexican boundaries does in fact cross State lines, it is international rather then interstate in character. This power was not included in the tabulations.

In cases of interchange of power across State lines by interconnected companies a consistent effort has been made to count and to total the kilowatt-hour transfers in each direction. The amounts shown therefore represent, in general, the "gross" transactions and not merely the preponderance of flow in one direction, or "net" figure. In a few cases, however, no metering was made by the company of flows back and forth. In these few instances, the figures reported represent "net" transactions only.

TABLE I

INTERSTATE TRANSFER OF ELECTRICITY—1928

	Total Consumption of Electricity* (Million Kwh.)	Interstate Power		Local Supply	
		Imported Into State (Million Kwh.)	Per Cent of Consumption	Total (Million Kwh.)	Per Cent of Consumption
Total U. S. A.**	83,147	8,920	10.73	74,227	89.27
New England	*5,447*	*789*	*14.5*	*4,658*	*85.5*
Maine	646	1	0.1	645	99.9
New Hampshire	230	9	3.9	221	96.1
Vermont	142	16	11.3	126	88.7
Massachusetts	2,638	495	18.8	2,143	81.2
Rhode Island	632	158	25.0	474	75.0
Connecticut	1,159	110	9.5	1,049	90.5
*Middle Atlantic***	*21,076*	*1,735*	*8.2*	*19,341*	*91.8*
New York**	10,777	55	0.5	10,722	99.5
New Jersey	2,319	279	12.0	2,040	88.0
Pennsylvania	7,980	1,401	17.6	6,579	82.4
East North Central	*20,441*	*1,324*	*6.5*	*19,117*	*93.5*
Ohio	5,737	581	10.1	5,156	89.9
Indiana	2,000	238	11.9	1,762	88.1
Illinois	6,546	292	4.5	6,254	95.5
Michigan	4,356	86	2.0	4,270	98.0
Wisconsin	1,802	127	7.0	1,675	93.0
West North Central	*5,441*	*1,514*	*27.8*	*3,927*	*72.2*
Minnesota	1,253	395	31.5	858	68.5
Iowa	857	51	6.0	806	94.0
Missouri	1,959	1,010	51.6	949	48.4
North Dakota	79	7	8.9	72	91.1
South Dakota	112	10	8.9	102	91.1
Nebraska	393	1	0.3	392	99.7
Kansas	788	40	5.1	748	94.9
South Atlantic	*8,408*	*1,807*	*21.5*	*6,601*	*78.5*
Maryland	988	413	41.8	575	58.2
Delaware	128	41	32.0	87	68.0
District Columbia	390	....	....	390	100.0
Virginia	1,034	75	7.3	959	92.7
West Virginia	1,382	327	23.7	1,055	76.3
North Carolina	1,745	570	32.7	1,175	67.3
South Carolina	852	5	0.6	847	99.4
Georgia	1,258	358	28.5	900	71.5
Florida	631	18	2.9	613	97.1
East South Central	*3,458*	*530*	*15.3*	*2,928*	*84.7*
Alabama	1,504	67	4.5	1,437	95.5
Tennessee	1,020	82	8.0	938	92.0
Kentucky	737	236	32.0	501	68.0
Mississippi	197	145	73.6	52	26.4
West South Central	*4,033*	*348*	*8.6*	*3,685*	*91.4*
Arkansas	345	221	64.1	124	35.9
Louisiana	596	36	6.0	560	94.0
Oklahoma	908	83	9.1	825	90.9
Texas	2,184	8	0.4	2,176	99.6
Mountain	*3,902*	*694*	*17.8*	*3,208*	*82.2*
Montana	1,626	6	0.4	1,620	99.6
Idaho	411	110	26.7	301	63.3
Wyoming	56	....	....	56	100.0
Colorado	501	2	0.4	499	99.6
New Mexico	55	8	14.5	47	85.5
Arizona	355	5	1.4	350	98.6
Utah	808	524	64.9	284	35.1
Nevada	90	39	43.3	51	56.7
Pacific	*10,940*	*179*	*1.6*	*10,761*	*98.4*
Washington	2,324	97	4.2	2,227	95.8
Oregon	941	38	4.0	903	96.0
California	7,675	44	0.6	7,631	99.4

*Notes:** "Total Consumption" is derived as shown in Note to Table III.
**Not including electricity imported from Canada.

Previous Statistics on Interstate Power—Harvard Study, 1926

In 1926 the Harvard Bureau of Business Research conducted the first extensive survey into the subject of the interstate transmission of power (Bulletin 68; Vol. XVI, No. 9, of the Graduate School of Business Administration, December 1927). The data developed by this study are on a comparable basis with the N.E.L.A. figures for 1928 with the one qualification that an appreciation of the value of records upon the subject of interstate power contributed towards a more complete reporting of this subject during the later year.

Extent of the Transfer of Electric Power Across State Lines in 1928

During 1928 the country's total consumption of electricity was 83,147,000,000 kilowatt-hours (exclusive of energy imported from Canada). Of this amount, 74,227,000,000 or 89.3 per cent, was generated and consumed within the same State. The remaining 10.7 per cent of the country's total consumption (or 8,920,000,000 kilowatt-hours) was transferred across State lines.

This compares with the total of 6,171,000,000 kilowatt-hours crossing State lines in 1926 as shown by the Harvard report, which was 8.99 per cent of a total consumption of 68,638,000,000 kilowatt-hours in that year.

The distribution of this power by States and by the major geographic divisions of the country is given in Table I (on page 1.)

Principal Interstate Power Plants

Thirty electric generating plants, built in whole or in part to serve power markets from which they were separated by State lines, contributed in 1928 two-thirds of all the interstate power in the United States. Table II gives a list of these thirty plants, when they began operation, the State of location, the market served and the percentage of total interstate power contributed by each plant or by each group of plants. The location and contribution of these principal interstate power plants affords an explanation of the

TABLE II

IMPORTANT GENERATING PLANTS—SEPARATED BY STATE LINES FROM THE POWER MARKETS FOR WHICH THEY WERE BUILT IN WHOLE OR IN PART. 1928

Name of Plant	Date of Original Installation	Located in State	Supplies Market of	Per Cent of Total Interstate Power Supplied from Each Group—1928
		WATER POWER PLANTS		
Vernon	1909	New Hampshire	Industrial Massachusetts	4
Davis Bridge	1924	Vermont		
Bellows Falls	1928	Vermont		
Holtwood	(1st Unit 1910) (Last Unit 1914)	Pennsylvania	Southern Pa. and Baltimore, Md.	4
Conowingo	1928	Maryland	Philadelphia, Pa.	9
Cheat Haven	1926	West Virginia	Pittsburgh, Pa., District	2
Catawba	1904	South Carolina	Industrial Piedmont Region of North Carolina	6
Dearborn	1922			
Fishing Creek	1916			
Rocky Creek	1909			
Wateree	1921			
Keokuk	1906	Iowa	St. Louis, Mo., Industrial Area	7
Jim Falls	1923	Wisconsin	St. Paul-Minneapolis, Minn.	4
Wissota	1923			
St. Croix Falls	1910			
Cove	1917	Idaho	Salt Lake City, Utah	3
Grace	1908			
Oneida	1915			
Soda	1924			
American Falls	1927	Idaho	Salt Lake City, Utah	3
Bishop Creek Plants	1905	California	Nevada mines at Manhattan, Goldfield, etc.	0.5
Bartlett's Ferry	1926	Alabama	Columbus, Ga.	0.5
Youghiogheny	1927	Maryland	Pennsylvania mines	0.5
Chalk Hill Rapids	1927	Michigan	Wisconsin	0.5
TOTAL WATER POWER				44%
		STEAM POWER PLANTS		
Sterlington	1927	Louisiana	Southern Ark. and Western Miss.	3
Montaup	1927	Massachusetts	Rhode Island	1
Lowellville	Before 1905	Ohio	Sharon-Mahoning Valleys, Pa.	2
Windsor	1917	West Virginia	Ohio industrial district, Pittsburgh region, Pa.	8
Cahokia	1926	Illinois	St. Louis, Mo.	6
Glen Lyn	1927	Virginia	West Virginia Coal Mines	2
TOTAL STEAM POWER				22%
GRAND TOTAL; PROPORTION OF TOTAL INTERSTATE POWER				66%

SUMMARY

TOTAL INTERSTATE POWER is to total electric supply—10.7%.

Percentage of TOTAL INTERSTATE POWER contributed by the above thirty plants—66%.

Percentage of TOTAL ELECTRIC SUPPLY contributed by these plants—7%.

TABLE III
CHANGES IN THE RELATIVE MAGNITUDE OF THE INTERSTATE TRANSFER OF ELECTRICITY—1926-1928
(1926 Ratios Computed from Figures as Reported by the Bureau of Business Research of Harvard University)

	1926			1928
	Total Consumption of Electricity* (Millions Kwh.)	Imported Power (Millions Kwh.)	Imports Are Per cent of Consumption	Imports Are Per Cent of Consumption
Total U. S. A.**	68,638	6,171	8.99	10.73
New England	*4,691*	*696*	*14.8*	*14.5*
Maine	498	1	0.2	0.1
New Hampshire	167	47	28.1	3.9
Vermont	164	21	12.8	11.3
Massachusetts	2,327	421	18.1	18.8
Rhode Island	551	155	28.1	25.0
Connecticut	984	51	5.2	9.5
*Middle Atlantic***	*18,093*	*697*	*3.9*	*8.2*
New York**	9,181	17	0.2	0.5
New Jersey	1,865	203	10.9	12.0
Pennsylvania	7,047	477	6.8	17.6
East North Central	*16,311*	*1,111*	*6.8*	*6.5*
Ohio	4,554	488	10.7	10.1
Indiana	1,657	147	8.9	11.9
Illinois	5,270	306	5.8	4.5
Michigan	3,189	43	1.3	2.0
Wisconsin	1,641	127	7.7	7.0
West North Central	*4,514*	*1,202*	*26.6*	*27.8*
Minnesota	1,036	196	18.9	31.5
Iowa	781	77	9.9	6.0
Missouri	1,582	886	56.0	51.6
North Dakota	56	6	10.7	8.9
South Dakota	69	3	4.3	8.9
Nebraska	346	1	0.3	0.3
Kansas	644	33	5.1	5.1
South Atlantic	*7,016*	*1,324*	*18.9*	*21.5*
Maryland	946	439	46.4	41.8
Delaware	105	10	9.6	32.0
District Columbia	308	....	....	....
Virginia	1,034	110	10.6	7.3
West Virginia	1,041	95	9.1	23.7
North Carolina	1,417	329	23.2	32.7
South Carolina	772	68	8.8	0.6
Georgia	896	272	30.4	28.5
Florida	497	1	0.2	2.9
East South Central	*2,883*	*259*	*9.0*	*15.3*
Alabama	1,307	8	0.6	4.5
Tennessee	890	11	1.2	8.0
Kentucky	565	182	32.2	32.0
Mississippi	121	58	47.9	73.6
West South Central	*2,592*	*163*	*6.3*	*8.6*
Arkansas	221	61	27.6	64.1
Louisiana	442	15	3.4	6.0
Oklahoma	503	86	17.1	9.1
Texas	1,426	1	0.1	0.4
Mountain	*3,365*	*553*	*16.4*	*17.8*
Montana	1,388	....	....	0.4
Idaho	362	79	21.9	26.7
Wyoming	50	....	....	....
Colorado	499	....	....	0.4
New Mexico	27	2	7.4	14.5
Arizona	187	5	2.7	1.4
Utah	769	421	54.7	64.9
Nevada	83	46	55.4	43.3
Pacific	*9,173*	*166*	*1.8*	*1.6*
Washington	1,730	97	5.6	4.2
Oregon	797	69	8.7	4.0
California	6,646	....	....	0.6

Notes: * "Total Consumption" is derived as follows:
Generated by electric light and power plants....................................
Add: Procured from enterprises not public utilities....................................
Add: Imported from adjacent states.................. ——————...... ....
Total ....
Subtract: Exported to adjacent states.................. ——————...... ....
Balance: "Consumption" in State....................................
**Not including electricity imported from Canada

wide variation as between States in the amounts of interstate power as shown in Table I. Their bearing on the interstate power question will be discussed more at length later in this report.

Comparison of 1928 *Imports with* 1926 *Figures*

Table III shows a comparison of the percentages of imports by geographical divisions and by States for the years 1926 and 1928. The 1926 figures were arrived at by a study of the Harvard report though they were not taken directly therefrom, inasmuch as the percentages in the Harvard report were based on generation within the State and not upon the corresponding consumption figures.

Considered by geographic areas, it will be noticed that the interstate movement of electric power in New England is comparatively high. This is largely the result of the supplying of the concentrated industrial district of central and southeastern Massachusetts and Rhode Island with hydro-electric power generated in southern Vermont and New Hampshire. The percentage of imports has remained approximately the same during the three year period.

Taking the Middle Atlantic States as a whole, the magnitude of the interstate transfer of power in the grand total of electric operations is relatively small. The relative percentage more than doubled, however, during the period. This increase is accounted for by the operations of one plant (Conowingo) whose power-house is located in Maryland, but which has been designed to supply the Philadelphia power market in Pennsylvania.

In the East North Central States, a similarly low proportion of imports exists and the percentage has remained substantially the same during the period.

In the West North Central area, the amount of power imported across State lines is relatively high. Three hydro-electric plants built in Wisconsin to serve the St. Paul-Minneapolis district, and a plant in Keokuk, Iowa, together with one in East St. Louis, Ill., built to serve the St. Louis market are primarily responsible for this high percentage, which has remained approximately the same during the period.

A considerable growth in imports is shown in South Atlantic and East South Central areas, both in actual amount and in the percentage of total power supplied. This is attributable, in part, to the recent placing in operation of a number of important waterpower projects, the absorption of whose initial output has caused a reaching out to markets in adjoining States. A second factor has been the availability of cheap natural gas in Louisiana, as a power source which has caused the replacement of local supplies in Arkansas and Mississippi with this cheaper power from Louisiana. This natural gas burning plant in Louisiana has also affected the percentage of imports in the West South Central geographical area, where the interstate movement is comparatively small, but which has substantially been increased by the transfer of power from Louisiana to Arkansas.

In the Mountain States, the percentage of imports to total power supply remains approximately the same but is comparatively high. This, however, is almost entirely due to the fact that the water powers of southeastern Idaho have been developed to serve the Salt Lake City market. The very small power market of Nevada is, in part, supplied from the water powers of the eastern slopes of the Sierras in California and the mining region of the northern tip of Idaho is similarly served from plants in eastern Washington.

In the Pacific area the amount of power entering into interstate transfer is negligible.

Exports of Power Across State Lines

Table IV shows, by States, the exports of power across State lines during 1928 as compared with the total volume of power generated within each State.

Discussion of Interstate Power by States

Table V shows those States where imports of power exceed ten per cent of the total consumption or where exports of power exceed ten per cent of the generation in 1928.

TABLE IV

EXPORTS OF INTERSTATE POWER BY ELECTRIC LIGHT AND POWER COMPANIES—UNITED STATES, 1928

	Power Generated (Millions Kwh.)	Power Exported (Millions Kwh.)	Exported Power Is Percentage of Generation
Total United States	81,868	8,920	10.90
New England			
Maine	645	....	....
New Hampshire	298	77	25.8
Vermont	445	320	71.9
Massachusetts	2,391	261	10.9
Rhode Island	480	10	2.1
Connecticut	1,075	29	2.7
Middle Atlantic			
New York	10,628	196	1.8
New Jersey	2,042	28	1.4
Pennsylvania	7,399	830	11.2
East North Central			
Ohio	5,346	357	6.6
Indiana	1,908	146	7.7
Illinois	6,932	730	10.5
Michigan	4,332	65	1.5
Wisconsin	2,097	441	21.0
West North Central			
Minnesota	846	62	7.3
Iowa	1,469	663	45.1
Missouri	989	40	4.0
North Dakota	85	13	15.3
South Dakota	105	3	2.9
Nebraska	431	40	9.3
Kansas	884	136	15.4
South Atlantic			
Maryland	1,476	912	61.8
Delaware	102	15	14.7
District Columbia	414	24	5.8
Virginia	1,168	222	19.0
West Virginia	1,961	906	46.2
North Carolina	1,075	22	20.5
South Carolina	1,433	586	40.9
Georgia	979	84	8.6
Florida	628	19	3.0
East South Central			
Alabama	1,482	370	25.0
Tennessee	956	28	2.9
Kentucky	567	67	11.8
Mississippi	51	1	2.0
West South Central			
Arkansas	143	21	14.7
Louisiana	822	264	32.1
Oklahoma	841	16	1.9
Texas	2,215	42	1.9
Mountain			
Montana	1,619	3	0.2
Idaho	845	570	67.5
Wyoming	47	....	....
Colorado	492	5	1.0
New Mexico	52	5	9.6
Arizona	330	....	....
Utah	283	....	....
Nevada	54	3	5.6
Pacific			
Washington	2,325	121	5.2
Oregon	1,015	126	12.4
California	7,667	40	5.2

By referring again to Table II, it will be noted that, almost without exception, the large export States are those within which one or more of the thirty named interstate plants are located. Conversely, the States whose markets are served by these interstate plants reflect a high import percentage. The Keokuk plant gives the State of Iowa a high export percentage. The Conowingo plant does the same for Maryland. Two hydroelectric plants in southern Vermont built for the adjacent market in Massachusetts, give Vermont a very high export percentage.

TABLE V

INTERSTATE POWER TRANSFER IN ORDER OF RELATIVE IMPORTANCE. STATES IMPORTING OR EXPORTING MORE THAN 10% IN 1928

IMPORTS

State	Consumption Millions Kwh.	Imports Millions Kwh.	Imported Power Is Per Cent of Consumption
Mississippi	197	145	73.6
Utah	808	524	64.9
Arkansas	345	221	64.1
Missouri	1,959	1,010	51.6
Nevada	90	39	43.3
Maryland	988	413	41.8
North Carolina	1,745	570	32.7
Delaware	128	41	32.
Kentucky	737	236	32.
Minnesota	1,253	395	31.5
Georgia	1,258	358	28.5
Idaho	412	110	26.7
Rhode Island	632	158	25.
West Virginia	1,382	327	23.7
Massachusetts	2,638	495	18.8
Pennsylvania	7,980	1,401	17.6
New Mexico	55	8	14.5
New Jersey	2,319	279	12.
Indiana	2,000	238	11.9
Vermont	142	16	11.3
Ohio	5,737	581	10.1

EXPORTS

State	Generation Millions Kwh.	Exports Millions Kwh.	Exported Power Is Per Cent of Generation
Vermont	445	320	71.9
Idaho	845	570	67.5
Maryland	1,476	912	61.8
West Virginia	1,961	906	46.2
Iowa	1,469	663	45.1
South Carolina	1,433	586	40.9
Louisiana	822	264	32.1
New Hampshire	298	77	25.8
Alabama	1,482	370	25.
Wisconsin	2,097	441	21.
Virginia	1,168	222	19.
Kansas	884	136	15.4
North Dakota	85	13	15.3
Arkansas	143	21	14.7
Delaware	102	15	14.7
Oregon	1,015	126	12.4
Kentucky	567	67	11.8
Pennsylvania	7,399	830	11.2
Massachusetts	2,391	261	10.9
Illinois	6,932	730	10.5

Character of Lines Crossing State Boundaries

Table VI, given below, shows the number of crossings over State boundaries of electric supply lines at the close of 1928, divided by the principal voltage classifications.

TABLE VI

NUMBER OF CROSSINGS OVER STATE BOUNDARIES—1928

Voltage	No. of Lines
11,000 volts up to 33,000	159
33,000 volts up to 66,000	143
66,000 volts up to 110,000	85
110,000 volts up to 220,000	50
220,000 volts	1
Total high tension..	438
2,300 volts up to 11,000 volts	72
Total crossings	510

General Discussion of Factors Affecting Interstate Power

It becomes apparent from a study of each of the separate interstate transactions that the primary reasons for the interstate transmission of electricity may be classified under three headings:

(a) *Generating plants separated from their normal markets by State boundaries.* In this classification are included all generating plants which were constructed primarily for the purpose of supplying energy to specific territories that, by what might be termed an accident of geography, are located in adjacent States. Thirty such plants are listed in Table II and, in round numbers, these thirty plants account for 6,000,000,000 kilowatt-hours or two-thirds of all electricity crossing State lines.

(b) *Interchange of power,* occasionally or permanently, between companies having their own sources of energy, but operating in adjoining States. This power exchange may be continuous or intermittent, and the flow may take place in either direction.

(c) *Extension of minor transmission or distribution lines,* across State boundaries to serve contiguous territory not so economically accessible to the lines of other companies operating in that State.

These last two classes divide between them, on an approximately equal basis, the remaining third of the electricity crossing State lines.

Generating Stations Separated from Their Power Markets by State Lines

Each large city or industrial area is a power-consuming center. To serve this market, the cheapest sources of power supply have been and are always being sought, taking into consideration the cost of producing and the cost of transmitting such power.

While in general, the distances from large generating plants to their market centers throughout the country are short when compared with the dimensions of the individual States, there are many large cities and industrial centers which are located on or near rivers which constitute political boundaries. It therefore, happens that a few large generating plants serve markets which, though not far distant, are separated from them by one or possibly more State lines.

A few examples will serve to make clear this situation and will also point out the fact that the transfer of power across State lines in quantity is by no means a new development in public utility operation.

The Keokuk plant on the Mississippi River at Keokuk, Iowa, was built in 1906 to supply St. Louis, 145 miles by air line to the Southeast. The initial development of the Holtwood hydroelectric plant on the Susquehanna River at McCalls Ferry in Pennsylvania, 10 miles north of the Maryland boundary, was completed in 1910 to serve the market of Baltimore, 40 miles away. To supply the Salt Lake City, Utah, power market the most favorable power sites are located on Bear River, partly in the State of Utah but principally across the boundary in the State of Idaho, and some 20 years ago these power developments were undertaken. The latest important hydro-electric development contributing to an interstate market is the Conowingo plant on the Susquehanna River, south of the Pennsylvania-Maryland State line. Although only partially completed in 1928 this plant, built to supply the Philadelphia market, contributed 9 per cent of all the interstate power in the country.

In more recent years the economies arising from the concentration of production of steam power in large units favorably situated with respect to a supply of condensing water and to the receipt of fuel, together with the increasing difficulty of obtaining real estate for power plant purposes in large cities, have resulted in the location of a few steam plants in States adjacent to those where the output was to be used.

The Cahokia steam plant, built in 1925 for the primary purpose of supplying St. Louis, was located on the east bank of the Mississippi in Illinois, across from and immediately below the city. The Windsor plant in the West Virginia "Panhandle" went into operation in 1917 primarily to serve both the Pittsburgh, Pa., region to the east and the southeastern Ohio industrial district to the west. The Glen Lyn, Virginia, plant of the Appalachian Electric Power Company was located on the New River, at a point where two major coal-carrying railroads converge, near the boundary line between Virginia and West Virginia. The plant, itself, is located in Virginia although much of the energy generated was to be used in the mining region of West Virginia, immediately to the South and West. The most recent addition to the list is the Sterlington, La., plant, whose location was dictated by the availability of the Monroe natural gas field and whose power is largely used in the interconnected systems of Arkansas to the north and Mississippi to the east.

Interchange of Power Between Companies in Adjoining States

The interconnection of power systems over large areas has been one of the most notable of the more recent developments of electric service. To an increasing extent, the widespread interconnected systems are becoming the country's reservoirs of mobile and reliable power for all purposes, and this has brought about a comparatively large number of transmission lines crossing State boundaries. While the number of crossings are large, the actual amounts of power which they carry for any given period are small as compared with the total power consumed.

The interchange of power between interconnected systems in 1928 accounted for about 1/6 of the total transfer of interstate power.

Temporary Increase in Interstate Power Due to New Plant Construction

A sudden increase in the percentage of power entering into interstate transfer ensues whenever a newly built "interstate" plant goes into operation. For two reasons, however, this increase in percentage is of a more or less temporary character. In the first place, subsequently built intrastate power sources automatically decrease the general ratio, though the kilowatt-hours transferred from the interstate plant may remain the same. In the second place, a large plant implies as a corollary to its construction a potential supply of cheap power in its immediate vicinity and it has been the general history of such plants that gradually there develops a local demand for their output, which progressively cuts down the amount of power available for supply to the more distant markets. If the plant is located in a region adaptable to industrial development, it has thus been the experience that there is a steady drift of certain classes of heavy manufacture toward it.

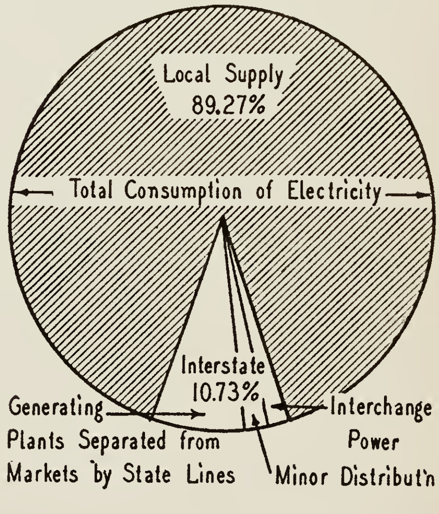
As the population of these centers of heavy manufacture increase, further markets for power arise through the secondary demand for store lighting, small commercial use and domestic consumption. The Niagara frontier has thus developed into a compact industrial region, based upon cheap electric power. An industrial load has developed at Keokuk, Iowa, which takes a very substantial part of the output of the plant and so cuts down the amount available for export to St. Louis.

Large transient increases in interstate power also come from plants built primarily for intrastate markets, because of the present practice of building them in very large units and insuring the fact that they will be fully loaded from the start by effecting a coordinated expansion program which may comprise territory extending into two or more States. This is often referred to as "staggered" construction. When such plants go into operation, there is a considerable increase in percentage of interstate power until such time as the local market catches up with their output.

Essentially Local Character of Power Supply

It costs money to transmit electric energy. To the expense of land and equipment there must be added the cost of energy loss through transmission. In any case, it is the economic distance, not the physical possibility which will ultimately govern, and the economic distance power can be moved depends upon the relative cost of producing it at the center of load as compared to the cost of producing it at some point distant therefrom, where conditions for power production may be favorable. While there are special conditions in parts of the United States which have brought about long-distance transmission, in general transmission distances have shown a strong tendency to remain short.

A review of the movement of electric power during the past few years indi-



THE EXTENT OF INTERSTATE TRANSMISSION OF ELECTRICITY, 1928

TABLE VII
INTERSTATE POWER WITHIN JURISDICTION OF STATE REGULATION—1928

	Total Consumption of Electricity (Million Kwh.)	Intra-State Supply (Million Kwh.)	Total Imports (Million Kwh.)	Per Cent of Consumption		
					Imports	
				Local Supply	(b) Direct Distribution	(a) Wholesale Transactions
Total United States	83,147*	74,227	8,920	89.27	6.62	4.11
New England	*5,447*	*4,658*	*789*	*85.5*	*9.4*	*5.1*
Maine	646	645	1	99.9	0.1	....
New Hampshire	230	221	9	96.1	....	3.9
Vermont	142	126	16	88.7	7.8	3.5
Massachusetts	2,638	2,143	495	81.2	14.5	4.3
Rhode Island	632	474	158	75.0	7.6	17.4
Connecticut	1,159	1,049	110	90.5	6.1	3.4
Middle Atlantic	*21,076**	*19,341*	*1,735*	*91.8*	*5.4*	*2.8*
New York	10,777*	10,722	55	99.5	....	0.5
New Jersey	2,319	2,040	279	88.0	0.3	11.7
Pennsylvania	7,980	6,579	1,401	82.4	14.3	3.3
East North Central	*20,441*	*19,117*	*1,324*	*93.5*	*4.3*	*2.2*
Ohio	5,737	5,156	581	89.9	7.8	2.3
Indiana	2,000	1,762	238	88.1	0.3	11.6
Illinois	6,546	6,254	292	95.5	4.0	0.5
Michigan	4,356	4,270	86	98.0	1.5	0.5
Wisconsin	1,802	1,675	127	93.0	4.6	2.4
West North Central	*5,441*	*3,927*	*1,514*	*72.2*	*19.5*	*8.3*
Minnesota	1,253	858	395	68.5	31.5	....
Iowa	857	806	51	94.0	3.7	2.3
Missouri	1,959	949	1,010	48.4	29.8	21.8
North Dakota	79	72	7	91.1	8.9	....
South Dakota	112	102	10	91.1	8.0	0.9
Nebraska	393	392	1	99.7	....	0.3
Kansas	788	748	40	94.9	5.1	....
South Atlantic	*8,408*	*6,601*	*1,807*	*78.5*	*10.9*	*10.6*
Maryland	988	575	413	58.2	2.7	39.1
Delaware	128	87	41	68.0	1.5	30.5
District of Columbia	390	390	....	100.0	....	....
Virginia	1,034	959	75	92.7	6.0	1.3
West Virginia	1,382	1,055	327	76.3	10.8	12.9
North Carolina	1,745	1,175	570	67.3	32.4	0.3
South Carolina	852	847	5	99.4	0.6	....
Georgia	1,258	900	358	71.5	8.5	20.0
Florida	631	613	18	97.1	0.2	2.7
East South Central	*3,458*	*2,928*	*530*	*84.7*	*8.8*	*6.5*
Alabama	1,504	1,437	67	95.5	2.0	2.5
Tennessee	1,020	938	82	92.0	5.7	2.3
Kentucky	737	501	236	68.0	29.4	2.6
Mississippi	197	52	145	26.4	....	73.6
West South Central	*4,033*	*3,685*	*348*	*91.4*	*3.4*	*5.2*
Arkansas	345	124	221	35.9	7.3	56.8
Louisiana	596	560	36	94.0	5.8	0.2
Oklahoma	908	825	83	90.9	8.0	1.1
Texas	2,184	2,176	8	99.6	0.3	0.1
Mountain	*3,902*	*3,208*	*694*	*82.2*	*9.3*	*8.5*
Montana	1,626	1,620	6	99.6	0.1	0.3
Idaho	411	301	110	63.3	35.2	1.5
Wyoming	56	56	....	100.0	....	....
Colorado	501	499	2	99.6	....	0.4
New Mexico	55	47	8	85.5	14.5	....
Arizona	355	350	5	98.6	1.4	....
Utah	808	284	524	35.1	25.8	39.1
Nevada	90	51	39	56.7	40.0	3.3
Pacific	*10,940*	*10,761*	*179*	*98.4*	*1.6*	....
Washington	2,324	2,227	97	95.8	4.2	....
Oregon	941	903	38	96.0	4.0	....
California	7,675	7,631	44	99.4	0.6	....

Note: * Not including electricity imported from Canada.

cates that the average distance traversed by the average kilowatt-hour in its path from power-house to consumer in the United States is only about 22 miles. If the production of the State of California, with its power plants for the most part in the Sierras and its use in the lowlands along the seacoast is excluded, the average for the rest of the United States is only 18 miles. It would seem, therefore, that in spite of the extraordinary progress in the interconnection of electric light and power systems and the extension of transmission lines during recent years, the great bulk of electric energy is consumed in the vicinity of the power plants.

PART II

Regulatory Aspects of Interstate Power Transfer

From Table VII it appears that electric energy consumed within the State where generated amounts annually to 74,227,000,000 kw-hr. or 89.27 per cent of the total supply. The remaining amount is that which enters interstate commerce, and is 8,290,000,000 kw-hr. or 10.73 per cent of the total.

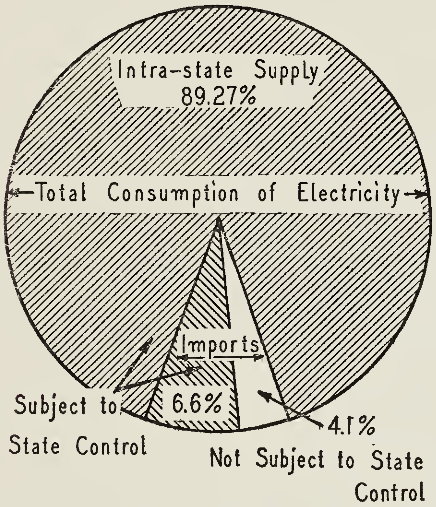
From the viewpoint of regulatory jurisdiction over rates, the 10.73 per cent of interstate energy is divided into two classes:

(a) Power generated in one State and sold to another company for distribution to customers in another State. For purposes of this discussion, this class is designated as "wholesale transactions."

(b) Power generated in one State and distributed to customers in another by the same company, no second company intervening between the generation in the one State and the distribution to customers in the other. For purposes of this discussion, this class is designated as "direct distribution."

Wholesale Transactions

The "wholesale" interstate transactions are exclusively within Federal jurisdiction, so far as concerns the direct regulation of the wholesale rate, although the rates which may be charged the ultimate consumer are subject to control by either State or local author-



THE EXTENT OF STATE CONTROL OVER THE SUPPLY OF ELECTRICITY IN 1928

ity. Of the total power consumed in 1928 in the United States, 4.11 per cent falls in this category. This is shown in Table VII.

Direct Distribution

The rates at which the "direct distribution" is sold to consumers are now within the jurisdiction of the State in which the sale is made, and will remain so unless and until the Federal government exerts its superior authority. Of the total power consumed in 1928 in the United States, 6.62 per cent falls in this category.

The dividing of interstate power into these two classes consists in determining in each instance whether it is sold by one company to another or passes direct to consumers.

The situation is complicated by the fact that in some instances the two companies involved in a wholesale transaction have the relation of parent and subsidiary, and the question arises as to whether sales between them are to be treated as independent transactions or whether the corporate duality is to be disregarded and the sale treated as direct from the generating company to the consumer. Without any attempt to determine the legal questions which thus arise, and since some standard is necessary, the classification in the following table is made by disregarding the corporate distinction in such instances if all of the stock, common and preferred, of the one company is owned by the other. (Fuel Gas Company v. Railroad Comsn., U. S. Supreme Court, Jan. 2, 1929). In such cases the second company has been disregarded, and the transaction treated as direct distribution. In all other cases, including specifically those in which all the common stock of one is owned by the other, but preferred stock is outstanding, the transaction is placed in the wholesale company-to-company class.

This classification may not be strictly accurate as to some situations, but any error that may exist cannot seriously affect the totals, which will remain substantially correct.

Table VII has been prepared on the foregoing basis and is intended to show the relative importance of the classes which make up the total of the power supply of the United States.